Studies have indicated that men in sedentary occupations are more liable to have coronary heart disease than those in occupations requiring moderate to heavy physical activity. To test this hypothesis a study was conducted of the death rates among clerks, switchmen, and section men employed in the railroad industry. The results are consistent with the hypothesis.

DEATH RATES AMONG PHYSICALLY ACTIVE AND SEDENTARY EMPLOYEES OF THE RAILROAD INDUSTRY

Henry Longstreet Taylor, Ph.D.; Ernest Klepetar, M.S.; Ancel Keys, Ph.D., F.A.P.H.A.; Willis Parlin, M.S.; Henry Blackburn, M.D.; and Thomas Puchner, M.D.

MORRIS, et al.,[1] demonstrated an association between the physical activity required by an occupation and the incidence of coronary heart disease over a period of two years among bus drivers and conductors employed by the London Transport Executive. Additional studies of postmen on the one hand, and telegraphers, telephonists, clerks, and supervisory personnel of the postal service on the other, also indicated a higher incidence of coronary heart disease among men in the more sedentary jobs than among men in the occupations requiring greater physical activity. In addition, it was found that men in sedentary occupations had less angina pectoris and a higher death rate during the first three months after an initial coronary attack than men in the more active occupations. Since that time, results of other studies in Great Britain[2-5] and in the United States[6,7] have supported the thesis proposed by Morris that men in physically active jobs have a lower incidence of coronary (ischemic) heart disease in middle-age than their contemporaries in sedentary occupations. However, this association was either not confirmed or was denied by several investigators[8-11] and it is evident that additional data are required to clarify this situation. It is the purpose of this paper to present data on death rates among physically active and sedentary employees of the railroad industry.

This industry was chosen because it offers a favorable epidemiological laboratory in which to test the hypothesis that men in physically active occupations suffer from less coronary heart disease than men in sedentary jobs. Both conditions within the industry and the operations of the Railroad Retirement Board tend to make occupational death rate data reliable and accurate.

The railroad industry is unusual in that occupational mobility between crafts within the industry is low. Conditions within the industry discourage men from shifting from one occupational class to another. Labor contracts between man-

Table 1

The Interstate Commerce Commission reporting division numbers (occupational classification) employed in this study and the titles of typical jobs found under each number.

General Classification	ICC Reporting Number	Typical Jobs
Clerks	6	Clerks and clerks specialists, accountant, statistician, cashier
	7	Claim clerk, file clerk, rate clerk, invoice clerk, bookkeeper, yard clerk, timekeeper, way bill clerk
	8	Key punch clerk, reproduction operator, expense clerk
	9	Stenographer, secretary to officers, stenographer clerk
	10	Dictaphone operator, personal stenographer
Switchmen*	119	Yard conductor, relief yard master, engine foreman
	120	Yard brakeman, yardman, yard helper, switchman
Section men	42	Section man—track and roadway section labor.

* A switchman is listed with the Railroad Retirement Board as a yard brakeman. Conductors and foreman are responsible for the operations of one switch engine and its three man switching crew, one of whom is the conductor.

agement and the brotherhoods contain seniority provisions which prevent a man from carrying the seniority acquired in one job to another controlled by a separate brotherhood. Since both privileges and income are attached to seniority, men seldom change from one occupation covered by a labor contract to another covered by a separate labor contract. The typical man with ten years of service entered the industry early and has remained a member of one brotherhood and held one type of job for the majority of his career. A 55-year-old switchman with 20 years of service in the railroad industry is likely to have spent from 17 to 20 of his service years as a switchman. Any changes in craft that such a man may have made in the great majority of cases occurred during his early years in the railroad industry. This situation provides an assurance that occupational classification at any specific time provides a reasonable description of current and past on-the-job physical activity.

A second substantial advantage offered by the railroad industry lies in the operations of the Railroad Retirement Board. The accuracy and completeness of the data available through the Railroad Retirement Board are high.

The board maintains an account for each man employed by any interstate railroad in the United States. It makes larger payments for both disability and old age retirement annuities than does Social Security. It pays death benefits to families of men dying in service, or men dying while holding old age annuities or disability annuities. The brotherhoods indoctrinate their members

and their members' families thoroughly with regard to their rights under the Railroad Retirement Act. It is believed that the number of eligible deaths not reported to the board is very small. However, one source of error comes from men who have withdrawn from the industry and have spent two or more years working for another employer. Men in this category are small in number. The calendar year withdrawal rate of men with more than ten years of service in the industry varies between 24 at attained age 40 to ten at attained age 55 and over. A composite withdrawal rate for the population under study is in the order of magnitude of 11 to 12 per 1,000. Death benefits of men who have withdrawn from the industry and then died are handled by Social Security. Deaths in this category are lost to the study but may be estimated from the experience developed in a 4 per cent sample of the railroad employees maintained by the Railroad Retirement Board and checked with Social Security.

After some preliminary investigation of working conditions within the railroad industry, it was decided to gather data on three groups of men whose occupations required three different levels of physical activity. Each occupational group on any given railroad was covered by a labor contract which discouraged shifting from one group to another. Clerks were chosen as representatives of men in jobs requiring moderate physical activity and section men as representatives of men in jobs requiring heavy physical activity. For reasons presented in the Appendix, it was decided to develop an exposure which would contain

Table 2

Men at risk, total deaths and death rates from all causes in Railroad clerks, yardmen, and section men. Exposure based on men employed in 1954 as defined in text, deaths in 1955 and 1956.

Age	40-44	45-49	50-54	55-59	60-64	Total
Clerks						
Population at risk	9,216	14,741	21,304	22,630	17,221	85,112
Deaths, number	40	84	197	333	345	999
Rate per 1,000	4.34	5.70	9.25	14.72	20.03	11.74
Age-adjusted rate*						11.83
Switchmen						
Population at risk	11,819	7,688	10,400	15,884	15,839	61,630
Deaths, number	35	40	97	197	269	638
Rate per 1,000	2.96	5.20	9.33	12.40	16.98	10.35
Age-adjusted rate*						10.29
Section men						
Population at risk	5,184	8,470	10,616	10,824	9,773	44,867
Deaths, number	13	41	76	100	111	341
Rate per 1,000	2.51	4.84	7.16	9.24	11.36	7.60
Age-adjusted rate*						7.62
Total						
Population at risk	26,219	30,899	42,320	49,338	42,833	191,609
Deaths, number	88	165	370	630	725	1,978
Rate per 1,000	3.37	4.34	8.75	12.77	16.93	10.33

* Based on age distribution of total population at risk.

Table 3

Death rates calculated as total deaths less deaths attributed to violence presented by five-year age groups along with the 95 per cent confidence interval.

Age	40-44	45-49	50-54	55-59	60-64
Occupation					
Clerks	3.69+1.47 −1.14	5.56±1.201	8.54±1.237	14.23±1.543	19.28±2.054
Switchmen	2.12+0.998 −0.774	3.77+1.641 −1.249	7.60±1.668	11.08±1.629	15.59±1.929
Section men	1.74+1.562 −0.965	3.78+1.545 −1.205	5.93±1.460	8.50±1.729	9.93±1.966

white men who had accumulated 114 months of service at the end of 1951, who were employed in 1954 and whose ICC reporting division number in 1954 was one of those listed in Table 1. A listing of the Social Security numbers of the men in the exposure was prepared. Deaths occurring in 1955 and 1956 among men in active service and retirement were accepted for the study if the age during the year of death fell in the range 40 to 64 inclusive, and if the Social Security number could be found in the listing of the exposure.

Results

The results are presented in Tables 2 through 6. The statistical significance of some of the results is presented in Table 7. The death rate from all causes among clerks is generally higher than in either of the more active groups. (Table 2). However, the differences between switchmen and clerks is not large enough to reach the 5 per cent level of significance in any of the quinquennial age groups except for ages 60-64 (Table 7). The difference between the section men and clerks is more clear-cut, reaching statistical significance in three of five quinquennial age groups. Switchmen have higher death rates from violence than clerks, while the violence rate among section men is intermediate between clerks and switchmen. Death rates which do not include deaths from violence show larger differences between activity categories than was found in the death rates from all causes.

The data in Table 3 are presented along with the 95 per cent confidence limits so that the order of magnitude of the limits will be easily available. The chi-square analysis shows that three out of five of the cells of quinquennial age groups in this comparison have reached the level of significance and that clerks as a whole have a significantly higher death rate than switchmen. Differences between clerks and section men were increased as the result of removing deaths from violence as were the levels of significance of the differences between the groups.

Deaths reported due to arteriosclerotic heart disease (International List, No. 420 and 422) are presented in Table 4. The group differences between clerks and switchmen and clerks and section men are highly significant (Table 7) when tested with the chi-square procedure. However, there are still two quinquennial cells in the clerk vs. switchmen comparison and one in the clerk vs. section men comparison that do not yield significant differences. ASHD deaths are 49 per cent of all deaths in the clerical

group as compared to 38 and 37 per cent of all deaths in switchmen's and section men's group. ASHD deaths account for 76 per cent of the difference in nonviolent death rates between clerks and section men. These data are consistent with the finding that significant differences exist between switchmen and section men in both total deaths and nonviolent deaths but not in ASHD deaths. It is of interest then to examine other causes of death with this in mind. Clerks and switchmen do not differ in regard to deaths ascribed to neoplasms (Table 5) but the section men appear to have lower rates from this cause. If violence, neoplasms, and ASHD are excluded, it is found that switchmen and section men have rates that are 87 and 70 per cent, respectively, of that found among clerks (Table 6).

Discussion

The results reported here are consistent with the hypothesis that men in occupations requiring at least moderate amounts of physical activity have fewer fatalities from coronary heart disease than do men in sedentary occupations. However, there are some questions which are not as yet answered. The present data contain only a few deaths (less than 2 per cent of the total deaths) which have occurred in the group that retired during the years 1954-1956. It will be necessary to collect death data for several additional years to see whether retired deaths are homogeneously distributed among the several activity groups. The present study would miss deaths occurring in men who had transferred out of the occupations studied here. However, data collecting procedures for a follow-up report on deaths in 1954 through 1958 have been revised to eliminate these uncertainties.

In addition, the data have certain other limitations which should be recognized. There appears to be little doubt that the employee population of the railroad industry contains a very large portion of the personality type adapted to the rigid rules and authority structure of the typical railroad in which the majority of activity is either prescribed by a rule book or carried out under directive from a company officer. There is no a priori reason to believe that the limitation of the sample to ten years of service through 1951 and employment in 1954 has produced bias between the groups to be compared. However, it does ensure that all individuals have made their peace with the social structure of the industry and that many individuals who did not like the environment have sought employment elsewhere. For this reason, the group under study cannot be

Table 4

Death rates ascribed to Arteriosclerotic Heart Disease (International List No. 420 and 422), 1955-1956. Numbers are in deaths per 1,000, totals are age-adjusted rates calculated as in Table 2.

Age	40-44	45-49	50-54	55-59	60-64	Total
Occupation						
Clerks	1.74	2.78	3.80	7.42	10.39	5.7
Switchmen	0.59*	1.69	3.27	5.03	6.69	3.9
Section men	0.39*	1.31	2.46	4.08	4.20	2.8

* Rate calculated with less than ten deaths.

Table 5

Death rates ascribed to neoplasms. Numbers are deaths per 1,000. Totals are age-adjusted rates, calculated as in Table 2.

Age	40-44	45-49	50-54	55-59	60-64	Total
Occupation						
Clerks	0.54*	0.81	1.93	3.18	3.48	2.23
Switchmen	0.42*	1.04*	1.44	2.77	4.17	2.19
Section men	0.58*	0.83*	0.85*	1.85	2.66	1.47

* Rates calculated with less than ten deaths.

considered representative of all American males. Morris[13] has pointed out that such limitations are frequently built into epidemiological studies and conclusions can only be extended to the general population if several widely different approaches to the same problem (in this case, the relationship between physical activity and coronary heart disease) yield the same conclusion. Examples of other methods of approaching the problem which use correlated sampling methods are those of Keys, et al.,[14] who studied 96 to 98 per cent of the males in several small European communities and classified activity of the participants, and that of Morris and Crawford[3] who carried out a cooperative autopsy study on British subjects. The work of Morris, et al.,[1] with the London bus men may have limitations similar to the present study. (Table 7.)

The disproportionate death rates from violence among the several occupational groups raises the possibility that bias may be introduced because of the removal from risk of dying of coronary disease of a larger proportion of men in the switchmen than in either the clerical or track repair group. Some accidental deaths may have been precipitated by a coronary attack and therefore misclassified.

There are two sources of error which can be examined by making comparisons with the 4 per cent sample maintained by the Railroad Retirement Board. It was mentioned above that this sample includes all the deaths of men who have withdrawn from the railroad industry and worked elsewhere for two or more years. Furthermore, the reader will be aware that the definition of the exposure included only those men

Table 6

Death rates ascribed to causes other than violence, neoplasm and ASHD. Numbers are deaths per 1,000. Totals are age-adjusted rates, calculated as in Table 2.

Age	40-44	45-49	50-54	55-59	60-64	Total
Occupation						
Clerks	1.41	1.97	2.82	3.62	5.40	3.26
Switchmen	1.20	1.04*	2.89	3.27	4.74	2.86
Section men	0.77*	1.65	2.64	2.59	3.07	2.21

* Rate calculated with less than ten deaths.

who had 114 months of service in 1951 and who were also employed in 1954. Men who acquired ten years of service between 1951 and 1954 were not included in the exposure. The Railroad Retirement Board calculates and publishes the rate of death from all causes in a 4 per cent sample of all active service employees of all races and both sexes who have acquired ten years of experience in the railroad industry. In order to simplify the tabular material, the Railroad Retirement Board includes each of the occupational groups studied here along with others of a similar nature. For purposes of comparison with this study, the actuaries of the board calculated the death rate in the 4 per cent sample from all causes for the occupational groups reported here for males of any race who had ten years of service and were employed in any of the years 1954, 1955, and 1956. These rates are presented in Table 8 for the appropriate occupations along with those reported by the board for the larger occupational groupings.[15] For the purpose of comparison, an all-race rate was based on deaths in 1955 occurring in the laboratory cohort, plus the nonwhite employees who had 114 months of service in 1951 and worked in 1954. There is good agreement between the death rates calculated from the 4 per cent sample for occupations of interest to this laboratory (lines 2, 5, 8—Table 8) with the 1955 death rates calculated with the laboratory data (lines 3, 6, 9—Table 8). This suggests that serious error has not occurred because of the definition of the sample and loss of deaths to Social Security.

The published data of the Railroad Retirement Board differs from the work

Table 7

Values of chi-square found in testing the hypothesis that the death rates between occupations within a single age group do not differ from one another along with chi-square values which apply to the total age range. In the body of the table clerks are referred to as the office group, switchmen as the yard group, and section men as the track group.

Data Analyzed	Occupational Groups Tested	Age Groups 40-44	45-49	50-54	55-59	60-64	Total
Total deaths	Office vs. Yard	2.40	0.14	0.00	3.51	4.05	10.1
	Office vs. Track	2.56	0.59	3.40	16.8	27.7	51.1
	Track vs. Yard	0.13	0.05	2.77	5.58	12.7	21.2
Total deaths less violence	Office vs. Yard	4.04	2.93	0.65	7.01	6.30	20.9
	Office vs. Track	3.62	3.15	5.99	19.2	34.3	66.3
	Track vs. Yard	0.10	0.00	1.08	4.06	14.2	19.4
Deaths from ASHD	Office vs. Yard	5.20	2.07	0.41	7.95	12.8	28.4
	Office vs. Track	3.82	4.65	3.49	12.6	28.9	53.5
	Track vs. Yard	0.31	0.19	0.97	1.11	6.17	8.75

Criteria of significance of chi-square values

Level of Probability	Degrees of Freedom 1	5
5%	3.84	11.07
1%	6.63	15.09
0.1%	10.83	21.21

Table 8

Comparison of the death rates from all causes in the RRB 4 per cent sample, the RRB 4 per cent sample confined to occupations employed in this study, and the cohort used in this study. In all three cases the exposure included individuals of all races.

Source of Data	Sex	Dates	Occupations Included in Group	Age 40-49	50-59	60-64
1. RRB 4% sample[16]	both	1954, '55, '56	Station agent, clerks, office personnel	3.42	8.75	20.66
2. RRB 4% sample	males	1954, '55, '56	Clerks	6.0	11.2	23.8
3. Lab cohort+all races	males	1955	Clerks	4.7	11.8	20.6
4. RRB 4% sample[16]	males*	1954, '55, '56	Firemen, brakemen, switchmen	4.03	9.60	25.70
5. RRB 4% sample	males	1954, '55, '56	Switchmen	4.0	8.4	19.1
6. Lab cohort+all races	males	1955	Switchmen	3.6	10.7	17.4
7. RRB 4% sample[16]	males*	1954, '55, '56	Extra gang employees, section men	3.55	10.47	15.33
8. RRB 4% sample	males	1954, '55, '56	Section men	3.90	8.1	11.10
9. Lab cohort+all races	males	1955	Section men	3.88	8.00	12.42

* Females are not specifically excluded from these groups, but in practice only men are employed.

reported here because of the inclusion of other occupations in the reported groups. Thus, in line 1, Table 8, the clerk groups contain females and show a lower death rate than lines 2 and 3 where females are not included. In line 4 the RRB 4 per cent sample contains firemen and brakemen as well as switchmen. Since firemen and brakemen are considerably less active than switchmen, it is at least consistent with the thesis presented in this paper to find the rate for this group running higher than that found among switchmen alone. The RRB 4 per cent sample presented in line 7, Table 8, contains extra gang employees who are characterized by less regular railroad employment and a higher proportion of nonwhite personnel which may well account for the increased death rate in this group as compared to that of the section men alone (lines 8 and 9).

The distribution of clerks, switchmen, and section men along the railroad line is of interest since there is evidence from other data that rural areas have lower death rates than urban centers. In most large railroad companies there are more clerks in the city (typically a large city) in which the general office is located than there are either switchmen or section men. In the case of the switchmen the industry as a whole has a better distribution between large metropolitan centers and rural communities because terminal, transfer, and switching companies operate in large metropolitan areas and employ two or three switchmen for every clerk. On the other hand, there appears to be little question but that a larger proportion of section men

live in small communities than either clerks or switchmen.

Finally, it should be mentioned that interpretation of findings such as are reported here are dependent in part on a knowledge of the personal characteristics of the members of the active and sedentary group. Thus, Morris, Heady, and Raffle[16] have reported that the uniform size of the drivers of the London buses indicated that these men as a group were probably fatter than the conductors. The personal characteristics of switchmen and clerks of 20 cooperating railroads and switching and terminal companies operating in the northwestern part of the United States have been studied in the field and will be reported elsewhere.

Summary and Conclusions

1. A study was conducted of the death rates among clerks, switchmen, and section men employed by the railroad industry for the purpose of obtaining information on the relationship of physical activity of exercise and coronary heart disease.

2. The Social Security number, age, sex, months of service, and occupation for all male clerks, switchmen, and section men who had 10 years of service in the industry employed by Class I railroad and terminal and switching companies in 1954 were obtained from the Railroad Retirement Board.

3. For the purpose of this study, the cohort was defined as white males in the above occupations who had acquired 114 months of service by December 31, 1951, who worked in 1954 and were from 40 to 64 years of age.

4. Data from death certificates submitted to the board for men who died in 1955 and 1956 in active service or retirement were matched against the cohort list to identify deaths to be admitted to the study. Age and occupation specific death rates were calculated for total deaths and a number of specific causes.

5. A total of 85,112 man-years of clerks, 61,630 man-years of switchmen, and 44,867 man-years of section men were studied. Age-adjusted rates for all deaths were found to be 11.83 per 1,000 per year for clerks, 10.29 for switchmen, and 7.62 for section men. The age-adjusted rates for deaths ascribed to arteriosclerotic heart disease were found to be 5.7 per 1,000 for clerks, 3.9 for switchmen, and 2.8 for section men.

6. Since only a small number of deaths were reported in men who worked in 1954 and retired in 1955 and 1956, the death rates reported are for practical purposes in service death rates. It is planned to follow the cohort for several additional years to study the effects of deaths in retirement and to obtain a larger experience.

7. It is concluded that the results are consistent with the hypothesis that men in sedentary occupations have more coronary heart disease than those in occupations requiring moderate to heavy physical activity.

APPENDIX

The Railroad Retirement Board makes up an IBM punch card (wage study card) on each individual who is paid by any interstate railroad in the United States during each calendar year. In addition to certain information on income, this card contained in 1954 the Social Security number, year of birth, sex, race, total number of service months,* service months in the calendar year plus service months in each of the preceding four years. A wage study card was obtained for males of any race employed during the calendar year 1954

* The board defines service months as starting on January 1, 1937.

in the occupations listed below who had 120 months of service in the period January 1, 1937 to December 31, 1954. The occupations on which data were obtained were clerks, switchmen, section men, dispatchers, and selected skilled trades such as carpenters, electricians, and so forth.

Data from death certificates of men who died either in service or after retirement were requested from the Railroad Retirement Board. The data were collected in conjunction with a study of death rates in railroad employees being conducted by the National Cancer Institute. The cancer study accepted men who worked in 1951 and had at least 114 months of service by December 31, 1951. Death data were collected under the above definition for all individuals who died in 1955 and 1956 and were employed in the occupations given above. It was decided that the initial study of death rates should be confined to clerks, switchmen, and section men, since insufficient deaths had accumulated in 1955 and 1956 to warrant examination of the deaths in the dispatchers and skilled trades. The actual Interstate Commerce Commission reporting division numbers of the several occupations reported here are presented in Table 1.

It was decided to develop an exposure which would contain men who had 114 months of service in 1951 and were employed in 1954 and whose ICC reporting division number in 1954 was one of those listed in Table 1. Deaths occurring in 1955 and 1956 were accepted for the study if the age during the year of death was in the range from 40 to 64 inclusive, and if the Social Security number could be found in a listing of the cohort.

The file of 217,607 wage study cards provided by the Railroad Retirement Board had to be cut down to those white males who had 114 months of service in 1951. Distribution by year of birth for only those white male employees who worked in both 1951 and 1954 and accumulated 114 months of service in the period 1937-1951, inclusive, was desired. The wage study card contained data which included the Social Security number, employer number, total months of service after January 1, 1937, months of service in 1954, 1953, 1952, and 1951, the ICC number, sex, and race. These data made it possible to design a program for an electronic computer to produce for each of the three occupational groups under study a frequency distribution by year of birth for only those white male employees who worked in both 1951 and 1954 and had accumulated 114 months of service in the period 1937-1951, inclusive. A uniform distribution of birth dates throughout the year was assumed. The number of men whose age in 1955 and 1956 would place them in one of the quinquennial age groups listed in Table 2 was calculated. The men who died in 1955 were removed from the 1956 exposure. No correction for the men who died in 1954 was possible since these data were not available.

Deaths which were eligible for the study were identified by matching the Social Security number on the death certificate with the listing of the cohort. Upon identification, the underlying cause of death was decided upon and reviewed by two physicians. It was then coded using the 1949 edition (6th edition) of the International Classification of Diseases.[17] Deaths coded under numbers 420 and 422 were considered to include deaths due to coronary heart disease and are referred to below as arteriosclerotic heart disease (ASHD). Confidence intervals for death rates related to cells having at least 35 deaths were calculated using the formula St. D.= $\sqrt{\frac{pq}{N}}$ where q=observed death rate, p = (1-q) and N = the number of indi-

viduals at risk. Where the number of deaths is less than 35, the error in the preceding formula becomes appreciable and a better estimate of the confidence interval was obtained through the assumption of a Poisson distribution.[18]

ACKNOWLEDGMENTS — The authors wish to thank the statisticians in the Office of Research, Mr. Walter Matscheck, director, and the actuaries of the office of the chief actuary, Mr. A. M. Niessen of the Railroad Retirement Board, for advice and assistance. Completion of this work would not have been possible without the careful attention to detail and willing help of Mr. Norris Schultz and Miss Joan Bakula of the Laboratory of Physiological Hygiene, and the cooperation of Mr. Frank Doyle of Mutual Service Insurance Companies.

REFERENCES

1. Morris, J. N.; Heady, J. A.; Raffle, P. A. B.; Roberts, C. G.; and Parks, J. W. Coronary Heart Disease and Physical Activity of Work. Lancet ii:1053,111 (Nov. 21 and 28), 1953.
2. Brown, R. G.; Davidson, L. A. G.; McKeown, T.; and Whitefield, A. G. W. Coronary Artery Disease: Influences Affecting Its Incidence in Males in the Seventh Decade. Lancet ii:1073, 1957.
3. Morris, J. N., and Crawford, M. D. Coronary Heart Disease and Physical Activity of Work, Evidence of a National Necropsy Survey. Brit. M. J. 2:1485, 1958.
4. Morrison, S. L. Occupational Mortality in Scotland. Brit. J. Indust. Med. 14:130, 1957.
5. Morris, J. N. Health and Social Class. Lancet i:303, 1959.
6. Zukel, W. J.; Lewis, R. H.; Enterline, P. E.; Painter, R. C.; Ralston, L. S.; Fawcett, R. M.; Meredith, A. P.; and Peterson, B. A Short-Term Community Study of the Epidemiology of Coronary Heart Disease. A.J.P.H. 49:1630, 1959.
7. Breslow, L., and Buell, P. Mortality from Coronary Heart Disease and Physical Activity of Work in California. J. Chronic Dis. 11:421–44, 1960.
8. Life Insurance Companies Institute for Medical Statistics at the Oslo City Hospitals. Myocardial Infarction, an Epidemiologic and Prognostic Study of Patients from Five Departments of Internal Medicine. Acta. med. scandinav. 154:Suppl. 315, 1956.
9. Chapman, J. M.; Goerke, L. S.; Dixon, W.; Loveland, D. B.; and Phillips, E. The Clinical Status of a Population Group in Los Angeles Under Observation for Two or Three Years. A.J.P.H. 47:33 Part II (Apr.), 1957.
10. Stamler, J.; Kjelsburg, M.; and Hall, Y. Epidemiologic Studies in Cardiovascular Renal Disease in Chicago and Illinois. I. Analysis of Mortality Trends by Age-Race-Sex-Occupation. J. Chronic Dis. 12:440, 1960.
11. Forssman, O., and Lindegard, B. The Post-Coronary Patient. J. Psychosom. Res. 3:89, 1958.
12. Niessen, A. M. Sixth Actuarial Valuation of the Assets and Liabilities Under the Railroad Retirement Acts as of December 31, 1953. U. S. Railroad Retirement Board, Chicago, 1956.
13. Morris, J. N. Uses of Epidemiology. London, England: E. S. Livingston, Ltd. 1957.
14. Keys, A.; Fidanza, F.; del Vecchio, A.; Mohacek, I.; Buzina, R.; and Blackburn, H. (To be published.)
15. Cowen, J. L. Occupational Differences in Separation Rates for Railroad Workers, 1954-56. Chicago, Ill.: The U. S. Railroad Retirement Board, 1959.
16. Morris, J. N.; Heady, J. A.; and Raffle, P. A. B. The Physique of London Bus Men: Epidemiology of Uniforms. Lancet ii:569, 1956.
17. World Health Organization. Manual of the International Statistical Classification of Diseases, Injuries and Causes of Death (Sixth Rev.). Bull. World Health Organ., 1948, Vols. I and II.
18. Ricker, W. E. The Concept of Confidence or Fiducial Limits Applied to the Poisson Frequency Distribution. J. Am. Statist. A. 32:349, 1937.

Drs. Taylor, Keys, Blackburn, and Puchner are associated with the Laboratory of Physiological Hygiene, University of Minnesota School of Public Health, Minneapolis, Minn. Mr. Klepetar is vice-president and chief actuary, and Mr. Parlin is actuary, Mutual Service Insurance Companies, St. Paul, Minn.

The investigations of the materials in the Railroad Retirement Board were supported by a grant-in-aid from the American Heart Association; other aspects of the work were supported by grant No. H3088 (C2) from the U. S. Public Health Service.